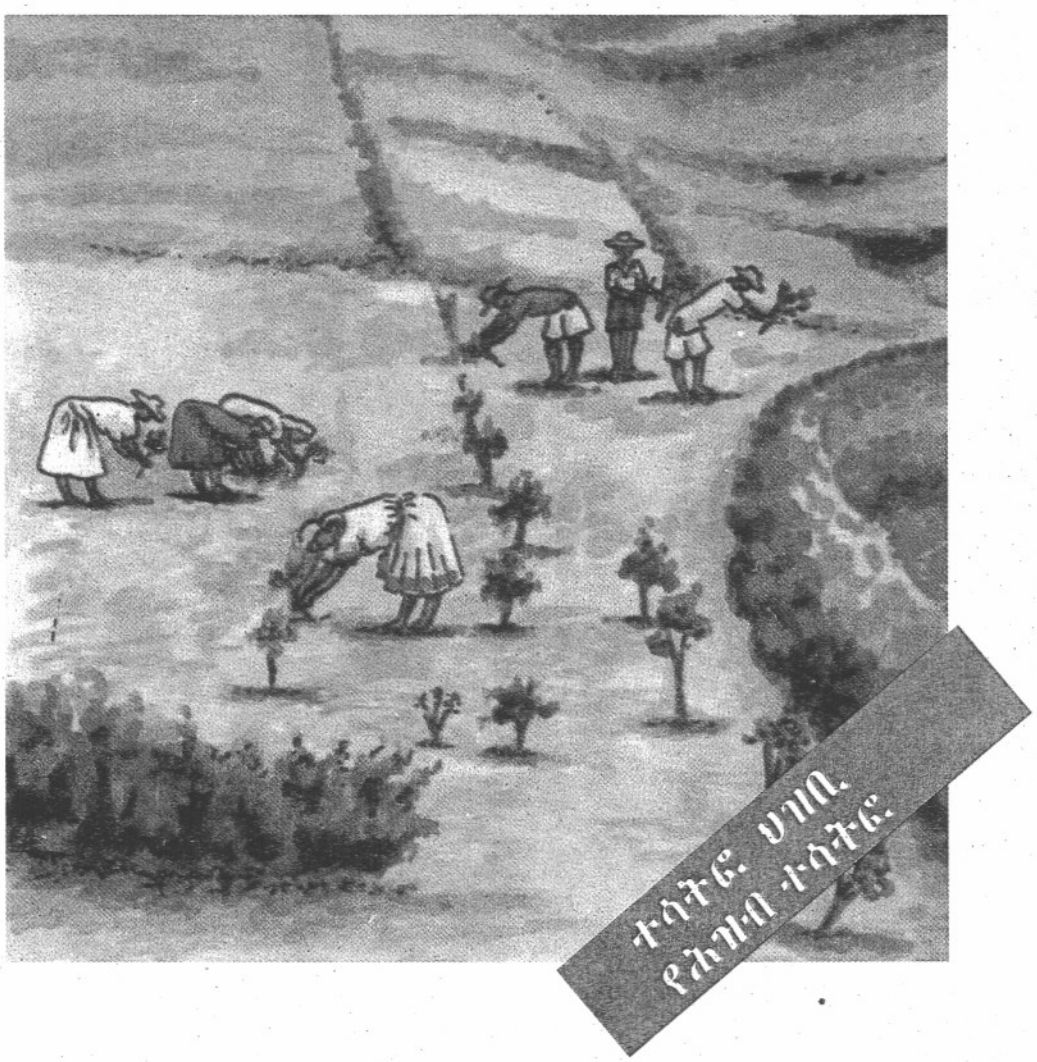
Towards a Tigray Regional Environmental and Economic Strategy (TREES)

A Contribution to the Symposium on Combating Environmental Degradation in Tigray, Ethiopia

Hans Hurni and Isabel Perich



Group for Development and Environment (GDE)
Institute of Geography
University of Berne, Switzerland

Berne, November 1992

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Mandate

This report was prepared for the Swiss Directorate for Development Cooperation and Humanitarian Aid (SDC) under the terms of a mandate from the Environment and Forestry Section of SDC to the Group for Development and Environment (GDE) concerned with methodological and technical aspects of environmental issues in development cooperation.

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List of Abbreviations

AD	Anno Domini (Christ)
bio	billion
CO_2	Carbon Dioxide
ECS	Ethiopian Catholic Secretariat
EELPA	Ethiopian Electric Light and Power Authority
EVDSA	Ethiopian Valleys Development Studies Authority
GDE	Group for Development and Environment, Institute of Geography, University of Berne
GED	German Emergency Doctors
GIS	Geographical Information System
GNP	Gross National Product
GTZ	German Technical Cooperation
IIED	International Institute for Environment and Development (England)
IUCN	World Conservation Union (Switzerland)
MoA	Ministry of Agriculture (Ethiopia)
MoE	Ministry of Education (Ethiopia)
MfM	Menschen für Menschen (NGO)
NGO	Non-Governmental Organisation
REST	Relief Society of Tigray
RRC	Relief and Rehabilitation Commission (Ethiopia)
SCRP	Soil Conservation Research Project (Ethiopia)
t	tonne(s)
TDA	Tigray Development Association
TOR	Terms of Reference
TREES	Tigray Regional Environmental and Economic Strategy
UNCED	United Nations Conference on Environment and Development
UNICEF	United Nations International Childrens Emergency Fund
WASWC	World Association of Soil and Water Conservation (Ankeny, Iowa, USA)
yr	year

Preamble

Over the past decades Tigray region in northern Ethiopia has been associated with war, famine, and a threatening degradation of natural resources. The latter appear to have been utilised without proper management since the Aksumite Empire, which declined around the 7th century AD. With the end of the civil war in Ethiopia in 1991, the opportunity arose for Tigray region to initiate a process of sustainable development and environmental conservation. In due course, the Relief Society of Tigray (REST) and the Tigray Development Association (TDA) invited 51 institutions and about 170 people in April 1992 to attend a 5-day symposium in Meqhelle on "combating environmental degradation in Tigray".

The paper presented here is a slightly edited version of the oral presentation given by the two authors during the symposium. It is basically addressed to the participants, and draws on experience gained in Ethiopia over a period of almost 20 years, as well as on the two-day field trip, giving some visual and personal insight into the region's natural and cultural diversity in a semi-arid environment.

In addition, the paper contains concrete proposals for concerted actions in sustainable development and may thus serve as a brainstorming tool for potential partners who would like to embark on projects in this field in collaboration with Tigray's development institutions.

Last but not least, the ideas presented in this paper provide a conceptual framework for environmental strategy developments as they are currently being discussed in the UNCED follow-up process. Tigray in this respect can be considered an area of considerable size with a clear potential for regional sustainable development. However, there is an extreme paucity of data on resources (both human and natural), a lack of information on resource dynamics, and a scarcity of financial and institutional resources and expertise. Without these prerequisites, it will be very difficult to provide urgently needed environmental strategy planning inputs in the required time.

This is also reflected in the Meqhelle declaration on environment and development presented as an appendix to this paper, where clear priorities for development are listed.

Summary

Recent developments in Ethiopia have made it possible to initiate a process of regional conservation strategy development in Tigray. This is intended as a follow-up to the National Conference on Conservation Strategy for Ethiopia held in Addis Abeba in May 1990. In 1992 Tigray, after a long period of political instability and war, provided an environment of peace and goodwill for development and thus invited over 170 people from 51 institutions to attend a five-day symposium in Meqhelle, including a two-day field trip to conservation and degradation areas along the road to Adigrat and Debre Damo (cf. Figure 13).

In this paper, which is a contribution to the symposium, we propose to discuss, elaborate and implement a "Tigray Regional Environmental and Economic Strategy", called TREES. TREES is a strategy which does not end with a publication or a "master plan". TREES will have to be process-oriented, emphasising the participation of local committees and concerned institutions over a long period. The TREES process should start with the development of a database as a prerequisite for the planning process. This should include the status of resources and information on their dynamic changes through degradation processes, as well as traditional and current ways of preventing such processes. Finally, TREES should have a continuous monitoring system designed to support implementation activities and their impacts on resources.

The combination of environment with economy is based on the recognition that without economic development and the eradication of poverty, environmental questions cannot be tackled adequately. Key issues in transforming the economy of Tigray in a sustainable manner include conservation-based agricultural development, adjustment of prices for agricultural goods, titling of land through regulation of ownership, management of common lands by communities, and calling for external assistance to subsidise the necessary non-productive agricultural activities such as terracing, grassland conservation, and the preservation of cultural diversity as well as the biodiversity of natural plants and animals.

Promising examples from all over Ethiopia are used to demonstrate the feasibility of the recommendations. In particular, it will be necessary to found a coordination unit for TREES to provide information and guidance during the process of implementation for all interested and participating bodies within and outside of Tigray. Finally, concrete steps are proposed at the end of the paper. These include a declaration on Tigray, establishment of the coordination unit, and enhancement of soil and water conservation as the most promising step towards an environmentally sound region that is self-sufficient in food production.

1. Some introductory remarks, a comparison, and an opportunity

1.1. Getting involved in Tigray's development

Dear participants, the invitation to attend the symposium in Meqhelle was forwarded to us by Ato Tesfay Belay of the Tigray Development Association, Ato Berhe W/Aregay of the Community Forests and Soil Conservation Development Department of the Ministry of Agriculture in Addis Abeba, and Dr Tewolde Berhan G/Egziabher of the Ethiopian Conservation Strategy Project in Addis Abeba. We gladly accepted it for five reasons:

The first reason was the personal interest of the first author, who had not seen Tigray for 18 years, and was wondering whether any changes in land use, land cover, and development could be subjectively detected after this long period of time.

The second reason was the professional curiosity of both authors, who represent a research group in Switzerland which concentrates its activities on questions of development and environment, particularly in the African context, and particularly in mountain environments. Members of the group have had a more or less continuous working experience in Ethiopia since 1974.

A third reason was the executive involvement of the first author in the World Association of Soil and Water Conservation (WASWC). This association includes over 600 experts working in soil and water conservation, who are distributed all over the world. Many of these experts' experiences can also be shared in Tigray.

The fourth reason was the scientific curiosity of both authors, who are trying to link environmental issues with development options. This is also a particular focus of the present symposium.

The fifth and final reason for accepting the invitation was our curiosity as Swiss nationals. We represent the viewpoint of a northern country, which enables us to make comparisons between two distant places on the globe.

1.2. A daring comparison between two regions

Switzerland (Figures 1 and 2) has much in common with Tigray, although this may not be obvious. The two regions are comparable in size: Tigray is about 80,000 km^2, and Switzerland about 40,000 km^2. About one-third of Switzerland, the high mountains, is unsuitable for human land use, similar to Tigray's lowland deserts. The population of Switzerland, about 7 million people, is comparable to that of Tigray (Asmerom Kidane, Symposium proceedings).

Based on area and population, it follows that Switzerland has a population density per km^2 which is double that of Tigray. Hence, it should not be surprising that Switzerland is less self-sufficient in food production than Tigray, although hardly anybody perceives this fact. Only 45% of the food consumed in Switzerland is produced within the country; the rest is imported, mainly from Europe and the developing world. For example, as a consequence of these imports, Switzerland "occupies" about 400,000 ha of cultivable land in developing countries for imports of coffee, maize for animal feed, etc. Here we already see some striking differences between the two regions.

However, Switzerland has also experienced deadly famines in the past, the last one in the spring of 1816 after a very cold and snowy

summer season in 1815. The people and the government reacted to these famines by favouring emigration, particularly to the Americas. Nowadays, such opportunities for emigration no longer exist, although a desperate and unsuccessful resettlement action in Ethiopia in the mid-1980s forced about 650,000 people from the northern regions to move to the southwest of Ethiopia, thousands of kilometres away from their places of origin.

Figure 1: Land use systems in Switzerland are generally well adapted to the environment. Steep slopes are forested, river borders are protected by earth walls and forests, and the gentle slopes are used for cultivation of crops. Photograph by Markus Zimmermann, 2 August 1984, in the "Emmental".

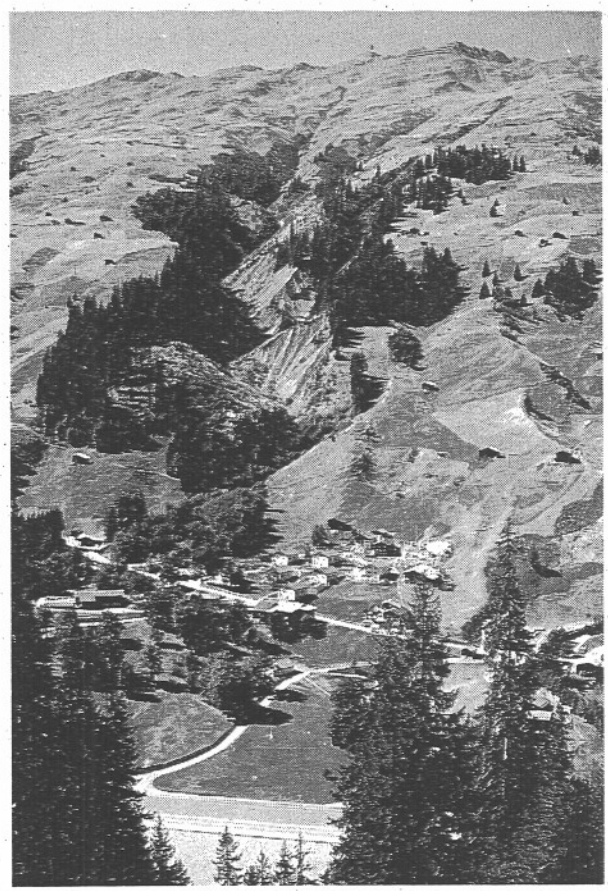

Figure 2: Mountains in Switzerland present many hazards to their human populations, such as torrents, gullies, landslides, and snow avalanches in the winter season. Nevertheless, human use is rather well adapted to these threats, and multiple uses of the mountains are possible for agriculture, hydropower, tourism and recreation with the assistance of the Swiss government through subsidies and special support programmes. Photograph by Hans Hurni, 9 September 1991, in the "Safiental".

There are other striking dissimilarities between Tigray and Switzerland, despite their common past. Switzerland has one of the world's highest gross national products, a GNP of approximately US $18,000, while Tigray has one of the lowest, a GNP of around US $100 per person per year. The Swiss primary (farming) sector occupies less than 4% about the population, while in Tigray, farmers make up about 85% of the population. This is a fundamentally critical issue to confront when linking environmental and development problems in Tigray (Figure 3).

This last contrast between Switzerland and Tigray, however, may be open to question in light of the UNCED considerations. The Swiss economy bases its wealth on a variety of factors and enabling conditions, such as cheap energy and technological development. By current standards, these latter two are not ecologically sustainable in the long-term. The threatening acceleration of global trends in climate change, air pollution, and destruction of the ozone layer indicate this. The question is whether economic development in the northern countries, which has resulted in the impressive GNP figures quoted above, can be made sustainable in the long run. There is thus an open debate over whether the North can serve as a model for developing countries, or whether a third way of development will have to be sought as a common model for both the North and the South.

1.3. A challenging opportunity for sustainable development

Our first impression from the field excursion to Adigrat and Debre Damo was very positive. Positive in the sense that we believe there is resource potential at least as high as that in Switzerland. For example, if water is better managed, much of the drought situation could be averted in future. The soils of Tigray are not totally eroded and lost, as we have repeatedly been hearing for many years. Extended areas of good soil have remained in place, particularly on valley floors, which could be used more productively but still in an ecologically sustainable way.

The general question is how to integrate sustainable use of all natural resources with development in Tigray, particularly in the poorly developed agricultural sector, and how to reduce the vulnerability to famine. We believe that this can only be done in an integrated way, combining and coordinating environmental rehabilitation with economic development (cf. also Whitcombe, 1992).

Our presentation tries to show the next steps to be taken "Towards a **T**igray **R**egional **E**nvironmental and **E**conomic **S**trategy". We call this process "**TREES**", an abbreviation of the title. In our view, there is a clear need for an integrated strategy in Tigray, hence for TREES.

Figure 3: Tigray's mountain environment is characterised by intensive human and livestock use. Steep slopes are virtually devoid of tree and bush vegetation, soils are degraded, land is overcultivated even on steep slopes, and farmers are forced to introduce "cactus" (Opuntia ficus-indica) around their homesteads as food and feed in drought years. Photograph by Hans Hurni, 16 April 1992 near Adigrat.

2. What is the "Tigray Regional Environmental and Economic Strategy" (TREES)?

2.1. What is a strategy?

Simply defined, the word "strategy", which comes from the Greek language, means "the design and execution of an overall concept with which the actor attempts to reach a certain goal".

Every person has many strategies. "How to get water" is a strategy, "how to grow maize" is another important strategy, and "how to make a soil bund" can be a strategy. Achieving sustainable development in Tigray is our strategy.

The term "environmental and economic strategy" follows the concept of sustainable development. According to Brundtland et al. (1987), "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The goal of "sustainable development", however, concerns a number of issues which have been listed by IUCN (1990a), as shown in Figure 4. It appears to be easier to differentiate between various goals of sustainability and to bring all together through different approaches.

Sustainable Development

Sustainable development is a process which allows development to take place without degrading or depleting the resources which make that development possible. This is generally achieved either by managing the resources so that they are able to renew themselves at the same rate at which they are used, or switching from the use of a slowly regenerating resource to one which regenerates more rapidly. In this way, resources remain able to support future as well as current generations. This is particularly important in eastern Africa where many millions of people are directly dependent on the resources in their immediate vicinity.

Three main principles are incorporated in sustainable development:

- **Ecological Sustainability** ensures that development is compatible with the maintenance of essential ecological processes, biological diversity and biological resources.
- **Social and Cultural Sustainability** ensures that development increases people's control over their lives, is compatible with the culture and values of the people affected by it, and maintains and strengthens community identity.
- **Economic Sustainability** ensures that development is economically efficient and that resources are managed so that they can support future generations.

Figure 4: A definition of sustainable development by IUCN, 1990a.

2.2. Why do we need a regional strategy?

This is the second question. The region represents some sort of a unit, be it technical, administrative, cultural, economic, or linguistic. This unit can form a basis for integration, i.e. for common thinking. Common thinking is necessary for sustainable development. When hearing the word "regional strategy", many people may think of a document, or of a guide which is constantly revised according to a framework of conditions. According to our definition, however, it is much more. It also means execution of the concept! A regional strategy, therefore, must be a development process and not a single report.

2.3. What does the word "environmental" mean?

"Environment" means the world around us. Environmental issues have become important because people have realised that human survival depends on nature staying healthy. Natural resources are all "gifts" of nature which are, unfortunately, not gifts, but loans to be refunded after use. Soils, water, vegetation, wildlife, and all derived cultural plants and livestock are basically products of nature to be used by human beings but not depleted irreversibly.

Taking care of natural resources is part of environmental thinking. This presumes knowledge of these resources. Natural and modified resources have to be identified and assessed in a spatial order. What is more important at present is the dynamic changes imposed on resources through intensified human use. It is particularly those irreversible changes which we do not perceive as problematic that are the most dangerous, such as changes in CO_2 content, in the ozone layer, or changes in soil depth here in Tigray.

2.4. Why is the word "economic" part of the strategy?

Economic questions are important even in a non-monetary system where farmers market very few surplus products. The efficiency of work, however, has always been important for agriculturalists. An example from Gununo area in Wolayta produced by Belay Tegene (1992) in Figure 5 shows the relationship between soil productivity and soil depth. Soil depth is an integral factor in soil and agronomic productivity; productivity will drop as soil depth decreases.

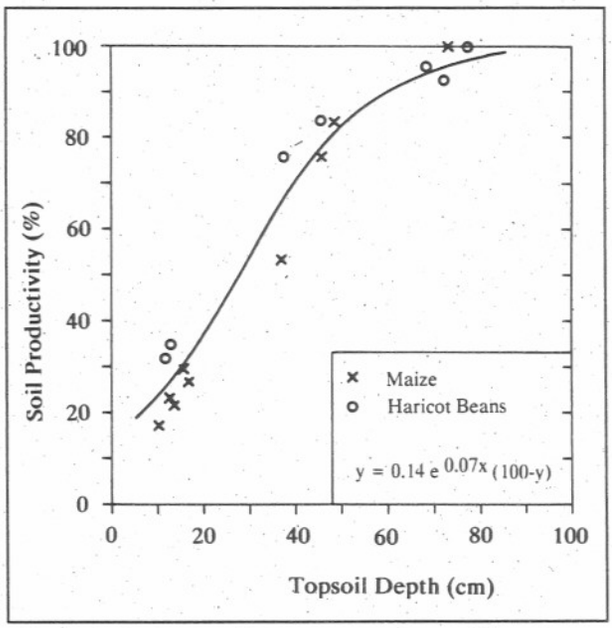

Figure 5: Erosion-soil productivity relationship for Eutric Nitosols in Gununo, Wolayta area, Ethiopia. Decreasing soil depth as a result of soil erosion will irreversibly affect the productivity of the soils. A soil 30 cm deep produces only half as much as a soil 100 cm deep. Source: Belay Tegene, 1992.

Tigray's soils could be classified as having lost about 30-50% of their productive capacity by comparison with their original state. A farmer today, with a labour input per unit area similar to the input of his ancestors some 500 years ago, only gets 50-70% of the yield they were obtaining when the land was first cultivated, assuming that the same farming system has been in use since that time. The changes caused by degradation were slow, increasing over generations. This slight decrease over long periods of time is the basic cause of unabated environmental degradation in Ethiopia (Hurni, 1993, forthcoming).

On the other hand, not only soil erosion, but also conservation has its own economy, as shown in Figure 6. Soil conservation by itself will not immediately increase a farmer's yields. On the contrary, during the first 5-25 years after conservation, the daily income will be reduced. This calls for long-term support of the farmer, be it in the form of incentives or subsidies to compensate the reduced income.

We have studied the effects of bunding on crop yields, with over 600 samples from farmers' fields (Yohannes G/Michael, 1992). These results were much less encouraging than the ones reported by Mulu Ayele (these proceedings). Looking at the overall field as one research plot, as the farmer does, we did not see significantly better yields after conservation in many cases, and where we did, the yields were only slightly better (15-47% increases) than in areas where there was no conservation. This small increase is not easily perceivable by the farmer. The main reasons for this are loss of land for crop production due to the space occupied by physical structures, and problems of rats, weeds, and land tillage with oxen.

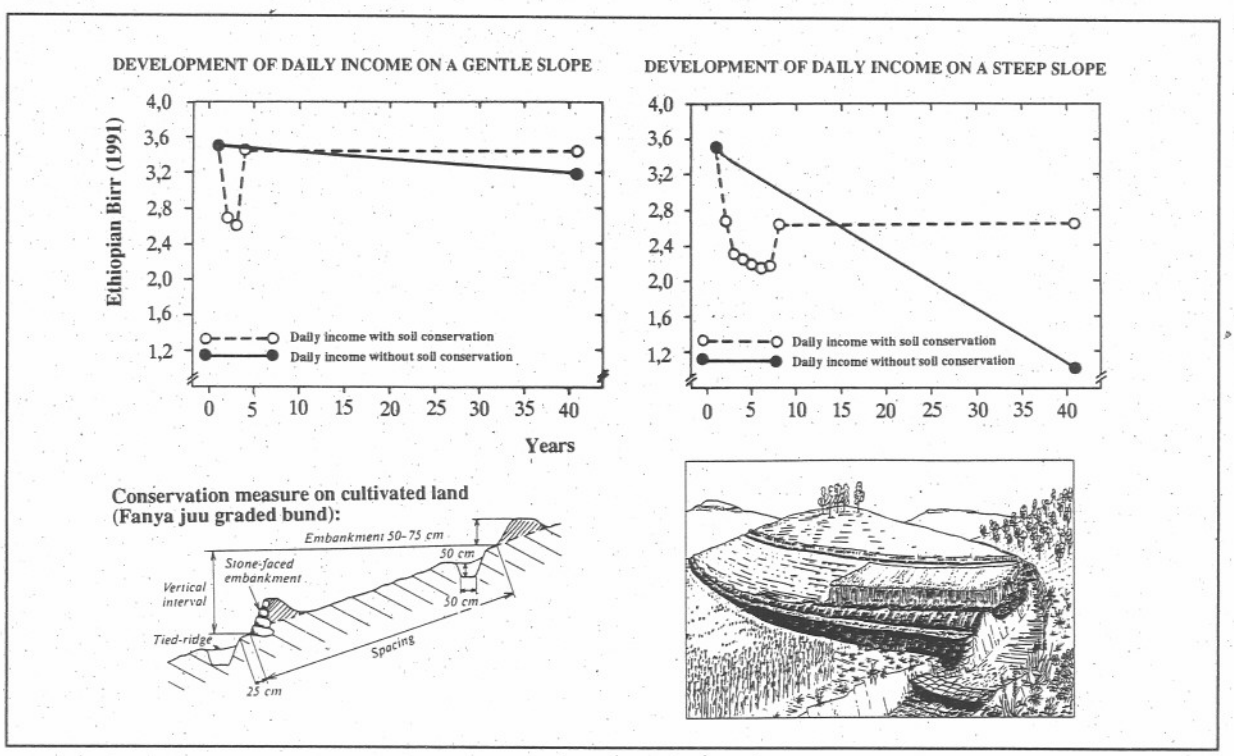

Figure 6: Average daily income of an Ethiopian farmer with and without soil conservation on cultivated land. Note the difference between gentle and steep farmland, and the long-term consequences of soil erosion if cultivated land is not conserved. However, also note that during the first 5-15 years the farmer will have less income if he conserves the soil. This calls for long-term subsidies for the period of conservation implementation to avoid negative reactions from the farmers for this seemingly non-productive activity. Source: E. Ludi, 1991.

We used these data and compared the gains in crop yields with the labour inputs required for conservation, and calculated the years which a farmer needs after applying bunds until he gets the same benefits he would without bunding (E. Ludi, 1991; cf. Figure 6). The figures obtained showed that it may take several years to reach this stage, and the steeper the slope the longer it takes because of the narrowness of the bunds required. For example, if the farmer has a 10% slope to conserve, it takes 2 years until the resulting benefits are equal to those expected without conservation. On a 40% slope, such a marginal farmer has to wait as long as 24 years until he gets the same benefits he would without conservation. From Figure 6 we can see how long a farmer will have to be subsidised if he applies bunds to prevent erosion on his fields. This is much more than what is offered in food-for-work schemes, and involves a much greater commitment from the national and international community.

2.5. Why integrate economy and environment?

In the UNCED conference in Rio de Janeiro in June 1992, environmental questions were closely associated with poverty, basic needs, economic growth, etc. There was virtually unanimous agreement that these goals can only be achieved together, and not through individual "strategies".

Integration in our context means:

- obtaining more **information** (on the resource base of a region, on the resource dynamics and particularly on dangerous processes, and on human developments and activities);
- reaching **consensus** (on participation, on resource allocation, and also on development goals);
- seeking **cooperation** (among farmers, communities, administration);
- attempting a **concentration** of resources in order to reach the critical mass of impact (i.e. managing scarce resources).

2.6. Women as managers of the environment

Another important issue to be emphasised in this context is the position of women in the society. Rural women play a major role in managing natural resources - soil, water, forests and energy. Their tasks in agriculture and animal husbandry as well as in the household make them the daily managers of the living environment. On the other hand, they are directly dependent on their immediate environment and their own skills in using it (Dankelman and Davidson, 1989).

During the civil war in Tigray rural women bore the bulk of the burden of rural life. Despite all kinds of projects and activities to improve their situation, the fate of women has not changed much (Organising Committee, 1992). They are still solely responsible for the household, preparing the meals, raising the children, gathering firewood, bringing in the water, taking care of the ill, washing and cleaning the house, as well as for many other tasks in agriculture and animal husbandry.

Hence, in an environmental and economic strategy for the region, the specific situation of women and their role as managers of the environment have to be emphasised. Access to education and employment as well as to household facilitators (eg. grinding mills, wells near villages, homestead groves for fuelwood, etc.), and particularly a radical change of men's attitudes, are needed to alleviate the burden borne by women and equalise their opportunities in society (Organising Committee, 1992).

3. Key issues in transforming the economy of Tigray

3.1. Introductory remarks

Resource management is influenced by many factors, from security of land tenure to political and economic orientation, from pricing of commodities to institutional and social aspects. We shall concentrate on some economic aspects which seem to be important in the current situation in Tigray and should be influenced by a regional strategy.

Figure 7 shows some key elements that form part of an integrated regional strategy from an economic point of view. In a way, they are prerequisites for TREES because they could serve as elements of a framework from which a concrete action plan can be formulated.

3.2. Developing the agricultural sector

One of the priorities for Tigray in terms of economic development is rural development. Emphasis should be given here to water resource development, where there is not only a tremendous need but also an apparent potential. Enough water could support the people needed to intensify agriculture and also allow them to dedicate their time and energy to other economic activities.

But developing the agricultural sector would require a change of priorities in national development policy in favour of the rural sector (cf. Figure 7). This change could open the door to better access to agricultural extension and rural services for small-scale farmers in Tigray. It could lead to a situation where a greater percentage of the national budget is used for rural development than is presently the case.

3.3. Changing agricultural policies

Developing the agricultural sector consequently means favourable agricultural policies. It implies a reassessment of existing governmental policies such as low prices for agricultural products or subsidies for activities with negative environmental impacts (e.g. fertiliser).

Increased crop prices might raise the returns and the income of peasants and allow them to invest in things that are necessary for their land, such as conservation measures. Low prices tend to discourage investment by farmers and surplus production at the same time. Hence crop pricing should encourage a sustained use of resources and not be an instrument of manipulation to serve other goals of the state. The system of fixed prices, wages, exchange rates and interest rates has been suspended in Ethiopia since 1990.

3.4. Defining rights of access to natural resources

Another crucial requirement for ecologically sound resource management is land titling, as discussed in the working groups during the symposium (cf. Figure 7). Access to land and rights to natural resources such as trees, plants and crops play an important role in a system of sustained resource management. At the same time, these are highly sensitive issues.

Land titling and formal rights are a prerequisite for many peasants before they can protect their land and invest in conservation measures. It is particularly the lack of clarity over these rights in the past that has led to situations of insecurity, uncertainty, and hence neglect in land care.

Key Elements of a Regional Environmental Strategy from an Economic Point of View

Developing the agricultural sector	- changing the priorities of national development policy in favour of the agricultural sector - providing better access to agricultural extension and rural credits - developing an agricultural subsidy system for sustainable land use
Changing agricultural policies	- reassessing existing governmental policies such as low prices for agricultural products, or subsidies for activities having negative environmental impacts - reducing taxes on products marketed by state systems - increasing the cost of industrial inputs
Defining the rights of access to natural resources	- definition of land tenure and rights to natural resources
Diversifying and promoting non-agricultural sectors	- relieving pressure on marginal areas - creating non-farm incomes - diversifying production sectors related to agriculture (based on local resources and minimal investment costs)
Assessing relationships with the national level:	- definition of the degree of regional self-determination - calculation of the influence of the national budgetary situation - estimation of the effects of debt on the local economy - evaluation of the function of the agricultural sector in relation to other sectors of the economy - assessment of the influence of fiscal policy
Evaluating dependence on the global economy (financial resources and subsidies):	- appraisal of the influence of the world market on the local economy

Figure 7: Economic elements of a regional environmental strategy. Source: I. Perich (forthcoming)

3.5. Diversifying and promoting non-agricultural sectors

From an ecological point of view, transformation of the economy means intensification of agriculture and a reduction of work inputs on the part of the agricultural sector. In Tigray more than 80% of the population is involved in the agricultural sector. As we have already heard in other statements, the economic development of the region most probably will not take place unless the rural economy is diversified.

What are the potentials for diversification? The most likely possibility is diversification into processed goods, mechanical production and workshops, and services. In a regional strategy for Tigray, emphasis should be placed on the possibilities of developing small-scale industries and craft activities based on local resources that have low investment costs.

One prerequisite for diversifying the econ omy is raising productivity in agriculture and surplus production. If food self-sufficiency is a goal, the people who dedicate their labour to non-agricultural activities have to be fed by the primary sector. In present-day Tigray, subsistence production is not even guaranteed at a farm household level, to say nothing of significant surplus production. As a consequence, people cannot reduce their present insufficient consumption for investment purposes, whatever long-term benefit this may have.

3.6. Assessing relationships with the national level

As pointed out previously, economic and environmental improvements in a region also depend on the influence of national factors on the local economy (cf. Figure 7). The national economic and political situation has major implications for a region like Tigray, since it will impact on natural resources and their use in a number of ways. Government activities in support of improved management of natural resources may be severely constrained because of limited national budgets. Hence, in order to formulate a regional strategy, it is crucial to assess relationships with the national level:

What is the existing degree of regional self-determination? What is the influence of the national budgetary situation and what are the effects of trade deficits and debt? What effects does national political instability have on the local economy? What is the influence of fiscal policy? And even: How much dependence is there on the global economy (e.g. commodity pricing, food aid)? A careful evaluation of these questions will be needed to formulate and implement adequate strategies for economic and resource development.

3.7. Financial resources...

Transformation of the economy also requires financial resources since it involves an increased integration of small-scale farmers into the market economy (cf. Figure 7). On the other hand, financial resources and credits for a peasant's household are very limited. Rural credit systems, open and sized appropriately to the requirements of small-scale farming, should be built up in a systematic way.

However, as we know from experience in other projects, credits have been useful only in combination with other measures, such as technical and other support. And they are only helpful when farmers are really able to invest in productive activities instead of direct consumption, which is the actual situation today for many households in Tigray.

3.8. ... and subsidies

As a consequence, subsidies for the agricultural sector might be the only realistic perspective at the moment, although this cannot be organised from within Tigray or Ethiopia. It will only work if foreign funding can be made available for such a system.

We might point to the situation in the industrialised countries, where the agricultural sector gets large amounts of subsidies from the other economic sectors, such as industry and services. In developing countries, on the other hand, the agricultural sector is not only expected to develop by itself, but also to provide the means for developing the other economic sectors. This is an objective which simply cannot be fulfilled in this context.

The international community, we think, becomes more and more aware of this situation as it becomes more and more aware that we all live from the same natural resource base. The United Nations Conference on Environment and Development (UNCED) in Brazil in June of 1992 was a sign of this awareness.

Let us just add one last remark relative to the community and grass-roots level. Actually, the missing financial and other resources in Tigray are replaced by a widespread involvement of the communities, by inputs from men, women and children in soil and water conservation activities. For people from outside, this is an impressive and fantastic thing. Isabel Perich's experience in Nicaragua, however, has shown that such goodwill does not last for a long time after a war situation if economic improvement is not achieved.

4. What are the next steps in the TREES process?

4.1. Improved integration of development activities

The importance of economic considerations in environmental and development projects has been shown in the previous chapter. This justifies inclusion of the word "economic" in the TREES acronym, instead of using other titles like "Conservation Strategy" (IUCN, 1980), or "Sustainable Development" (Brundtland et al, 1987).

In Tigray, despite the war situation, a great deal of afforestation and soil conservation has been carried out in the past 20 years, and there have also been many other sectorial inputs from numerous institutions and disciplines. These efforts are all extremely important. However, they need to be integrated much more in future. For example, any activity carried out in a specific area should be coordinated with other activities in the same area. There is little scope for dam construction in a valley without thinking of soil conservation, agricultural development, and changes in livestock development at the same time, and also mobilising the respective institutions (or departments within the same institution!) to join in a common effort. Without such coordination the dam may be filled with sediment within a short period and become an uneconomical investment and a disappointment to the land users of the area (cf. Table 1, p. 18).

4.2. Improved information among actor groups in Tigray

One way to improve things in this respect is to provide better information to people and administrative sectors about what can be done and what is being done in their region. Taking the example of the Tigray symposium, we fear that when the participants return home, they will take a lot of wisdom with them which can no longer be shared by the people who remain behind. We also believe that farmers have a lot of information to share, and this again is not made available to others, be they farmers or administrators. Finally, we believe that all administrative bodies here have a lot to share, but that they also do not communicate sufficiently and formally enough to supply everybody with the necessary information.

Certainly, the available information on human and natural resources in Tigray is very limited, since over the past decades not enough has been done in this respect. There is a great need for study groups and research projects to collect and supplement such information on a regional scale, taking into consideration the vast geographical, ecological, anthropological and institutional differences in the region. Second, it will be important to critically assess the options and impacts of development activities on human life, the economy, and the ecology of the

specific area. This is another major task for study groups and research teams.

The Soil Conservation Research Project (SCRP), which has one of its seven field research stations in Anjeni in Gojam region, may serve as an example of the benefits of long-term involvement of a research team in an area.

Figure 8 from the vicinity of the research area shows that land resources in Gojam are extremely scarce in the sense that under the traditional agricultural system all the land is occupied, and the trends are towards expansion of agricultural land at the expense of grazing land and forests. These dynamics were assessed by SCRP in Gojam, particularly soil and water losses from different

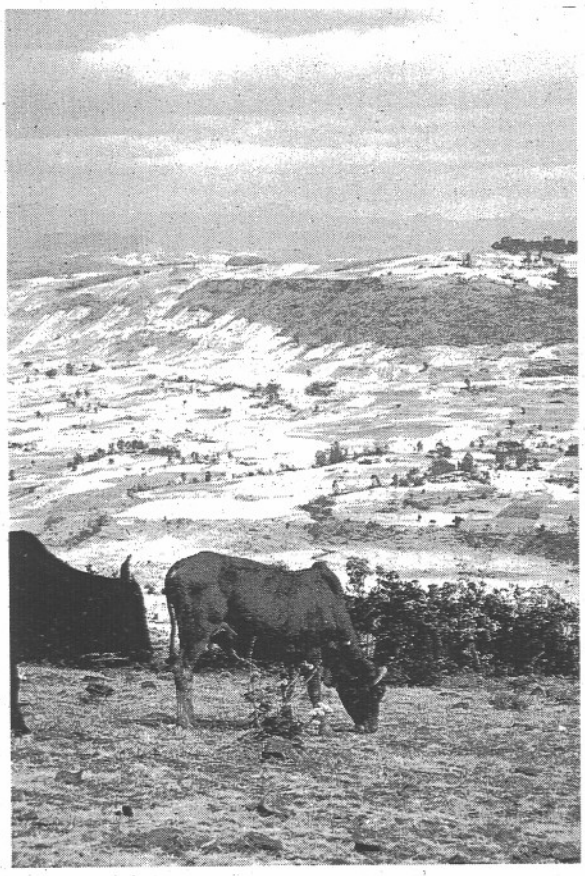

Figure 8: Land resources are also becoming extremely scarce in Gojam region, Ethiopia's breadbasket. Over 60% of the land is annually cropped even on steep slopes. The remaining bushland is overgrazed. Such land use will not support a population which is expected to double in the next 25 years. Degradation causes production losses in the order of 1% per year, i.e. it will cut production by about 25% in the same period. Photograph by H. Hurni, 1985, in Anjeni.

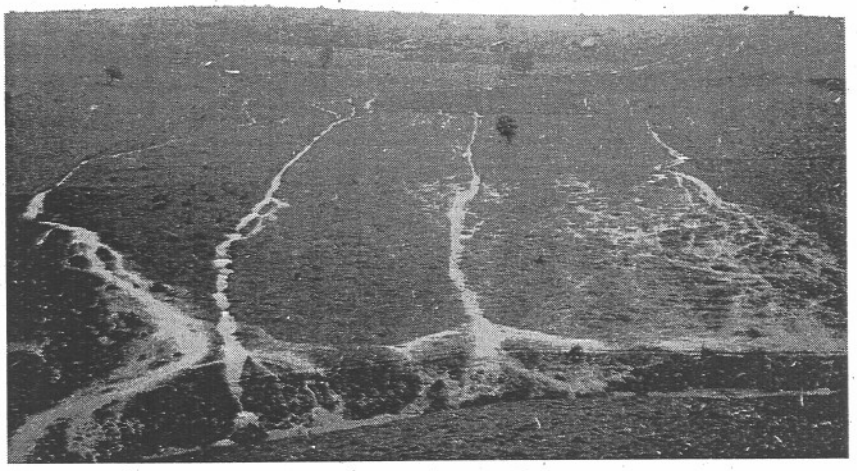

Figure 9: During the rainy seasons there is much surplus runoff which farmers drain from their fields in Anjeni, Gojam region. Sediment concentrations in this runoff are high, resulting in an average annual soil loss of approximately 60-97 tonnes per hectare in this 100-hectare catchment, or a soil depth loss of about 1 centimetre annually. Photograph by Christoph Werner, 1984, in Minchet catchment.

land use types and the catchment (Figure 9). The project further monitored the effect of soil conservation on sediment loss in a small catchment in Anjeni, an extremely laborious task involving local manpower as well as analytical and scientific support over many years. In this catchment, soil conservation was implemented using an innovative development approach, namely "social inputs for work" (Hurni, 1989). The Anjeni population received material and institutional support to build a local clinic, which SCRP helped to provide together with many government institutions. In exchange for this support, the community agreed to carry out soil conservation in the 97-hectare catchment where sediment loss was being continuously monitored.

In Figure 10 we can see that in the years 1984 to 1988 the total sediment losses in the catchment became smaller and smaller (SCRP, annual reports). Every one of the black dots in the figure represents about 1,000 samples of suspended sediment

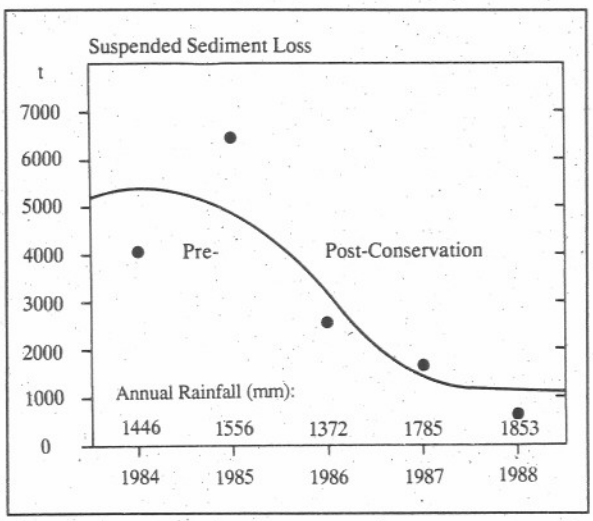

Figure 10: Annual suspended sediment loss in the Minchet Valley (97 hectares) in Anjeni, Gojam region. Note the positive effect induced by soil conservation in 1985/86 on the sediment loss of the catchment. However, the low losses observed after conservation can only be sustained if continuous maintenance of the terraces is guaranteed by the farmers. Source: Hurni, forthcoming.

analysed together with storm runoff for an annual total sediment loss. Through conservation, it was possible to improve the situation after 1986, with the cooperation of the farmers and without food for work. With labour input and much goodwill and participation at the local level, it is possible to change any bad environmental situation to a better one that is long-lasting and sustainable. Of course, there are still problems to be solved. Farmers did not really see the benefits of making terraces. They complained about narrow spaces in which to turn their pair of oxen, about rats who live in the bunds and destroy the grain, and about losing cultivable land through conservation. However, considering the long-lasting beneficial effect over the next decades, every means will have to be found to maintain this conservation system and to implement it everywhere in Ethiopia. The research results of SCRP fully support this assumption.

Making such information available to everybody is an important task for those who produce the information, hence the experience should be multiplied and institutionalised. For this purpose we recommend the founding of a coordination unit to serve as an information network and planning tool. Figure 11 gives an idea of the inputs and outputs of the proposed information and coordination unit of TREES in Tigray.

The elements we outline in our strategy are quite concrete (see Figure 11). However, they have to be specifically elaborated and need a considerable amount of inputs and expertise. Possible objectives and terms of reference for such a coordination unit would have to be established in cooperation with potential institutions willing to contribute to, and work with, such a unit. A first proposal is given in Appendix 1. External support by donor agencies, finally, will probably be indispensable for inputs at the initial stage.

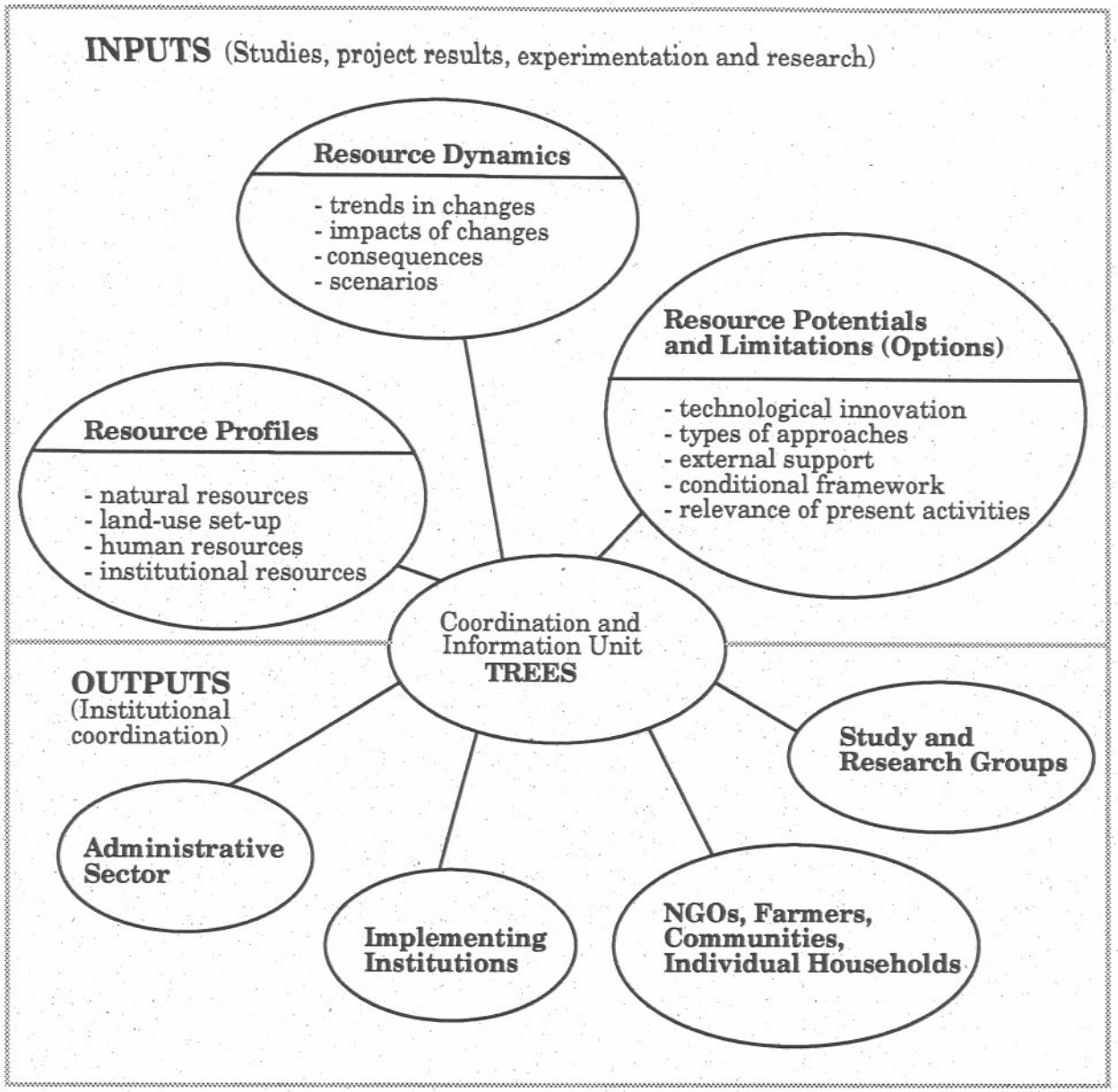

Figure 11: Elements of the TREES coordination network differentiated into inputs and outputs of the information units.

4.3. A promising tool for better information and communication

One particularly "modern" element for the proposed unit, to be used as a tool for storing and making available information on Tigray in a user-friendly way, and specifically prepared for individual purposes, is a Geographical Information System (GIS).

The GIS may become an excellent tool for assessing the status and the dynamics of the resource situation in Tigray. It would combine local and regional information available in Tigray with interpreted remote sensing data (air or satellite photos).

To give an example, Krauer (forthcoming) produced a bird's-eye view of central Tigray from a general GIS topographical model of Ethiopia, as presented in Figure 12. The respective base map at a scale of 1:1 million (Figure 13) was newly created for Ethiopia and used as an input for the model.

In Figure 12, towns like Meqhelle can be seen on the far right, the Tekeze River crosses the square, cutting off the Simen Mountains, and the excursion route of the symposium can also be shown easily. All this limited information was stored in the GIS on a computer, and is made available here as a preliminary example for potential users. In addition, problems like soil erosion and soil degradation, but also the distribution and dynamics of the population, reforestation activities, soil and water development, or the design of dam sites, roads, and many other development issues can be presented with such a GIS, and used by many institutions and organisations for planning, monitoring and policy formulation. One additional advantage of the GIS database over simple maps is its ability to be adapted to current needs at any time.

Our recommendation, therefore, is to produce such a GIS database for Tigray, to include all existing data that are already available, and to add new information as it is produced by the administration and other institutions. The implementation of such a GIS project, however, would need a donor agency willing to integrate such a component into its Tigray programme.

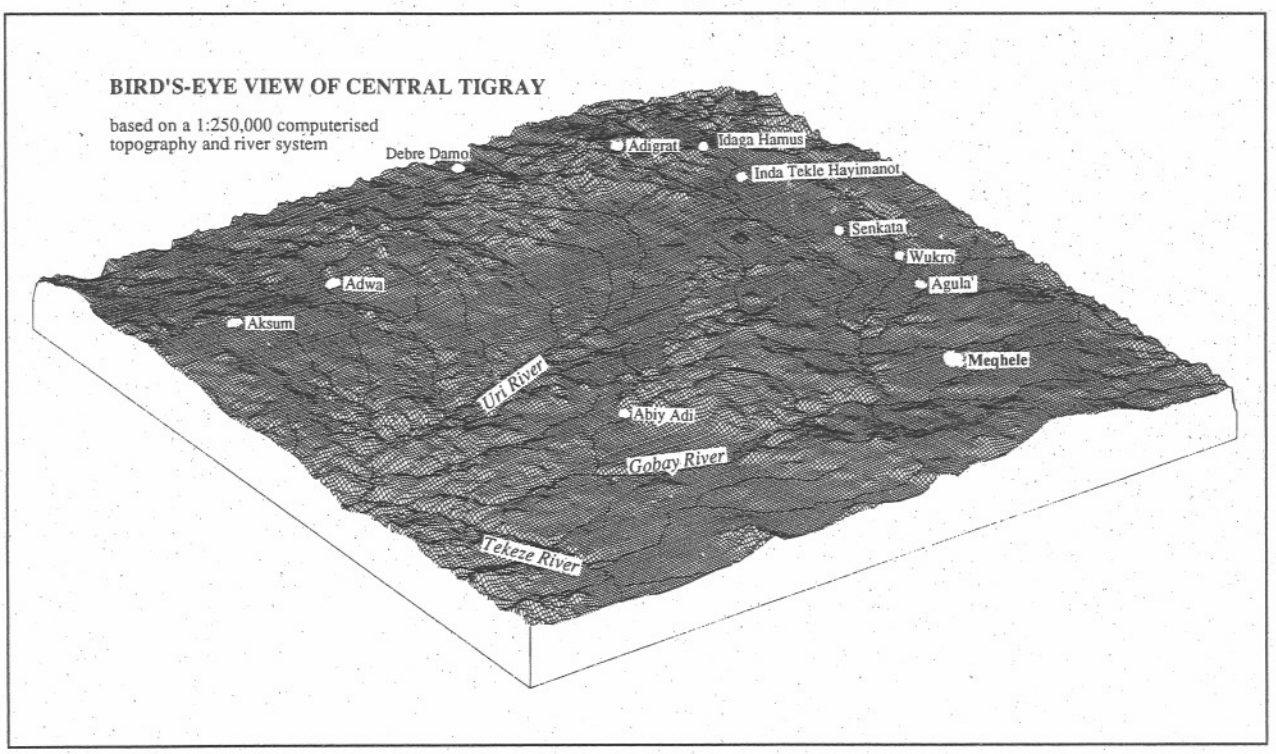

Figure 12: Three-dimensional "bird's-eye view" of Tigray developed from the GIS topographical information in Figure 13. In addition, layers of soils, geomorphology, land use, population distribution, and soil erosion data can be used to develop land resource scenarios for Tigray with the same GIS system (Krauer, forthcoming).

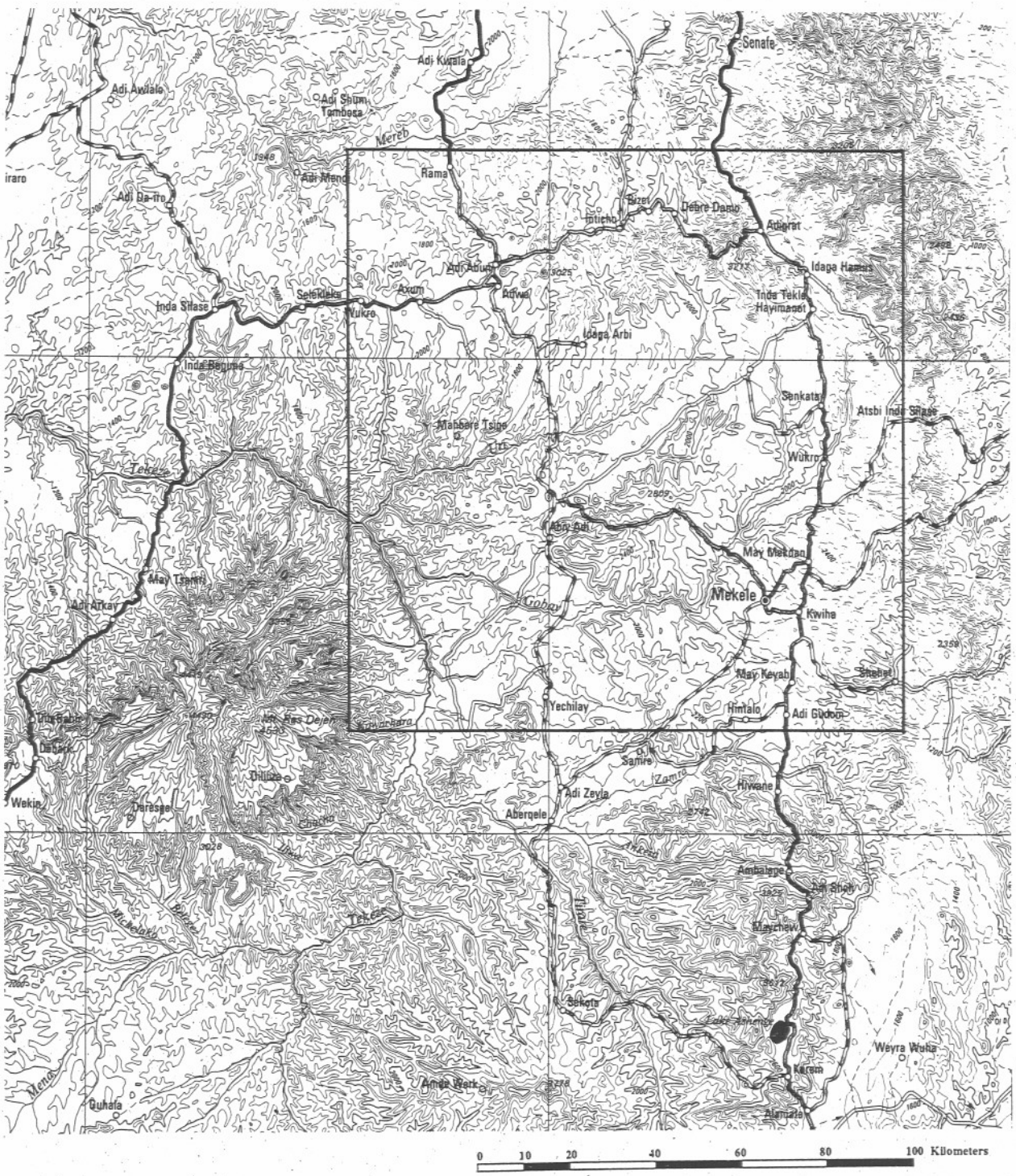

Figure 13: Reduced section of the recently created map of Ethiopia, on a scale of 1:1 million, which is based on 1:250 000-scale maps and a more recent field verification. This topography has been encoded into an Ethiopian GIS system to be used for national and regional planning such as TREES. The "bird's-eye view" in Figure 12 is taken from the marked section.

5. Instead of a conclusion: Three concrete proposals

5.1. A declaration on Tigray

Since the symposium participants represent a great deal of combined experience in environment and development in Tigray, we propose the drafting of a "Meqhelle Declaration on Environment and Development in Tigray". The participants should say something about the situation as they have seen it in Tigray and they should write it down in a manifesto of several pages, endorse it at the end of the symposium, and publish it locally, nationally, and also internationally to the greatest extent possible. This way, people will feel there is a positive process going on in Tigray that will be repeated in all other regions of Ethiopia and in Eritrea (see Appendix 3, showing that such a declaration was in fact formulated by a small group of three people and endorsed by the participants thereafter at the concluding session).

5.2. Establishing a coordination unit

Our second proposal is to establish a special office in Meqhelle called the Coordination Unit, for which the terms of reference (TOR) are given in Appendix 1. There are many institutions dealing with natural resource management in Tigray (Appendix 2), and many more are willing to embark on similar programmes (such as NGOs from outside Tigray). The proposed unit could be located within an appropriate institution of the administration of Tigray to be selected in a careful evaluation process. It would work as a small office which can make information available to whoever needs it. This is very important in preventing duplication of efforts in development programmes, where the linkages between development and environment are often forgotten.

5.3. Enhancing water and soil conservation

Water conservation is the most important option for rural development in Tigray. Water development, particularly through river diversions (Bokkers, Symposium proceedings), but also with small-scale earth dams (Figure 14) and even with larger-scale river dams, requires soil and water conservation in all catchment areas above the dams.

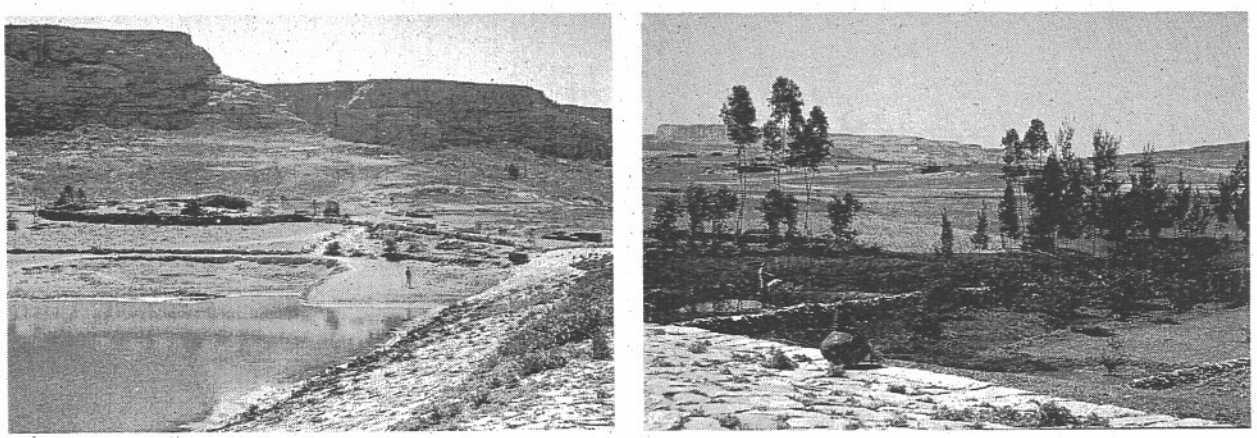

Figure 14: Water conservation and development provide the greatest challenge and opportunity for Tigray. Apart from small earth dams such as the one shown here, water conservation is of particular relevance with soil and stone bunding of cultivated land, which increases the water-holding capacity of the soil and water availability for crops. Photograph by H. Hurni, 17 April 1992, in Adi Chiwa between Senkata and Inda Tekle Hayimanot in Tigray.

Unless these catchments produce much less sedimentation downstream, project ideas like the one proposed by Tefera Wudneh et al. (Symposium proceedings) for a Tekeze River dam in the lowlands, intended to supplement irrigation for all of Tigray's population by 2040, are bound to fail.

crop production on the terraces and reducing sediment loss into the catchment at the same time (Berhe A/Aregay, Symposium proceedings). Proper spacing between the level bunds and a reduction of additional sources of runoff on the fields (paths, living areas, rocky areas) will be needed. In view

Table 1: Potential estimated siltation rate of a proposed Tekeze dam

Approximative catchment size: 50,000 km^2 ; Estimated annual runoff from the catchment: 6-10 bio m^3/yr; Estimated annual sediment delivery: 1000-4000 $t/km^2/yr$; Dam size for optimum irrigation: 4.5 bio m^3			
Runoff (billion m^3/yr)	Suspended sediment load ($t/km^2/yr$)	Expected sediment load (mio t)	Life expectancy of dam (years)
6	1000	50	90
8	2000	100	45
10	4000	200	22

As a justification for the above statement, we would like to give a very rough estimation, presented in Table 1, which shows that such a proposed Tekeze River reservoir may be filled with sediments within 22-90 years at best.

Apart from the negative off-site effects of soil erosion, the impact on the productivity of the soils on the slopes, and the resulting decline in agricultural production, there are other factors of utmost importance to the small-scale farmer (cf. Figure 5, p. 5). Hence, soil and water conservation will also be indispensable on all land used by farmers, all the more so since water conservation on the fields themselves will directly benefit soil water conditions and have a positive effect on crops, grasses, and trees. Applied measures, however, cannot be uniform but must be specifically designed according to a farmer's needs, economic potentials, available workforce, and agroecological suitability (Hurni, 1986).

On cultivated land, the development of level terraces from level soil and stone bunds is probably the best option for semi-arid Tigray (Figures 15 and 16). This will conserve water and soil alike, thus positively affecting

Figure 15: The improvement of traditional terraces by constructing stone bunds at their outward edges supports water conservation on the terraces. Area closures of steep slopes can be utilised by the local communities soon after revegetation has been established, although free grazing should be avoided in future. Photograph by H. Hurni, 17 April 1992, near Idaga Hamus in Tigray.

of the great need to treat all of the land, certain priorities among activities may be appropriate (cf. Krüger and Herweg in the Symposium proceedings).

Another major issue will be free grazing in the catchment areas. Livestock are now heavily overusing the limited grazing resources. Area closures would probably be much better and more economical on grazing land than the currently applied stone bunds, which are neither economically efficient nor ecologically effective in conserving grassland. Closed areas must be managed by the local communities, through organised grass cutting, eventually even through rotational grazing when the vegetative cover has been re-established after 1-2 years. The most important step in this respect is to obtain the consent of the community which traditionally uses the catchment before any intervention is prepared.

Figure 16: Stone bund construction on cultivated land is an excellent means of soil and water conservation and is urgently needed for all agricultural land in Tigray. Photograph by H. Hurni, 16 April 1992, at May Megelta between Senkata and Inda Tekle Hayimanot.

A third major land-use intervention is forest preservation and development. Unfortunately, this activity conflicts with the other two (primary) land use practices. However, small patches of natural vegetation have traditionally been preserved around the churches (Figure 17). Enhancing this traditional effort presents an excellent option for further collaboration between the churches, the farmers, and the administration.

Like many others, unfortunately, this issue cannot be further elaborated here, since this paper is based on only a few days of personal observations, some personal and other expert knowledge, and use of a rough GIS database as a source. The authors, nevertheless, hope that they have been able to provide a brief and suggestive contribution to sustainable development in Tigray region, both for those who attended the Symposium and those who read this paper.

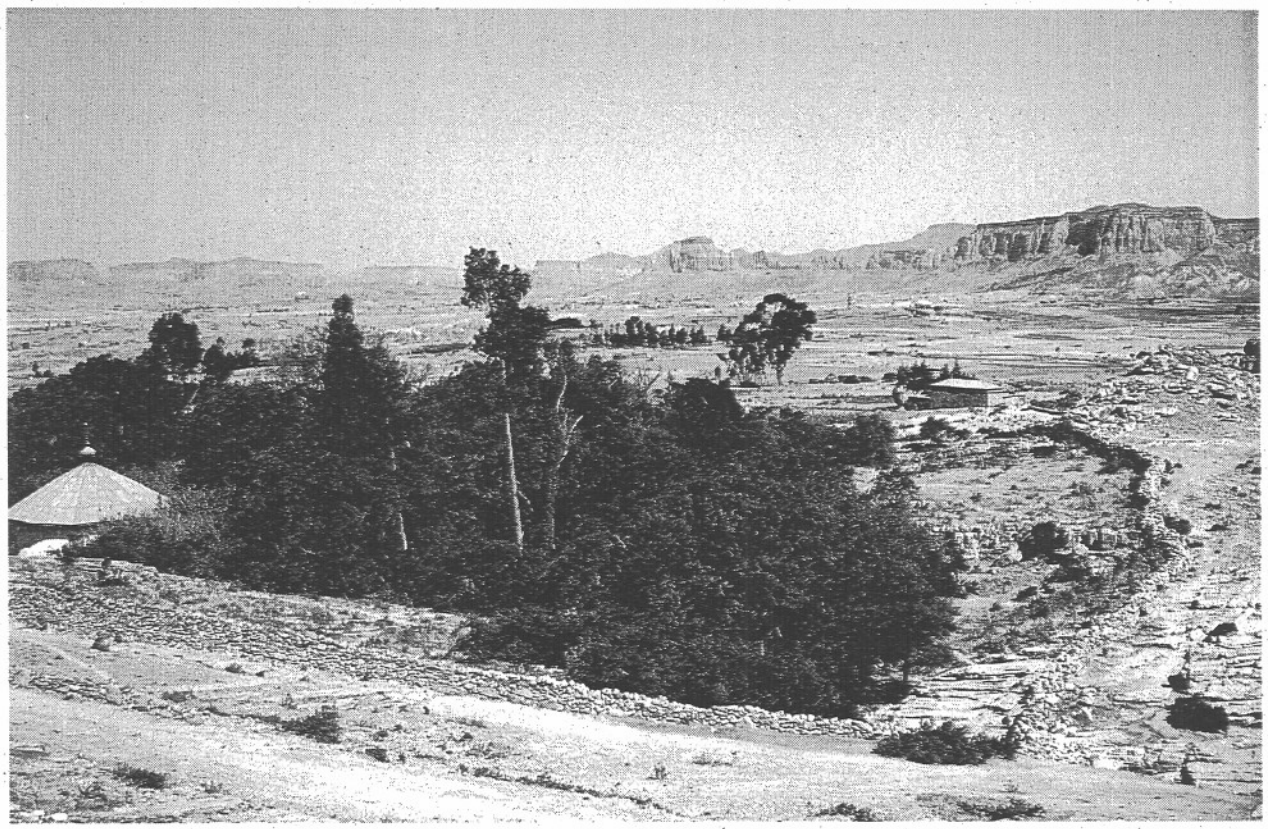

Figure 17: Tigray's biodiversity has been carefully preserved in part in small pockets of forests around churches. These are promising conservation sites which could be greatly expanded if a concerted effort between the churches, the population and the administration can be initiated. Photograph by H. Hurni, 4 April 1992, north of Terawa between Senkata and Inda Tekle Hayimanot.

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Appendix 1
April 1992

Terms of Reference (TOR) for a TREES Coordination Unit in Meqhelle

[Proposal by Group for Development and Environment (GDE) Berne]

1. Objectives of the Coordination Unit

The major task of the proposed Coordination Unit in Meqhelle is to coordinate all activities in the field of natural resource management in Tigray, and to build up an information network and planning tool for government institutions, mass organisations, NGOs, donors, and the public.

The primary objectives of a TREES Coordination Unit are:

(a) to create a participative follow-up mechanism to the "Symposium on Environmental Degradation" as an integrated part of the regional government;

(b) to compile, produce and provide information:

- on the status and distribution of the natural resource base in Tigray (biotic and abiotic resources, including climate);
- on the social, political and economic situation and dynamics of the human land users in Tigray;
- on the major trends and dynamics of human and natural resources in Tigray;
- on institutions, initiatives and activities concerned with natural resources in Tigray;
- on the results of monitoring and evaluation reports on activities in natural resource management;

(c) to coordinate natural resource management activities in Tigray by:

- setting priorities for actions in natural resource management;
- planning natural resource utilisation potentials;
- screening and evaluating the environmental impacts of interventions.

2. Duties of the proposed TREES Coordination Unit

The proposed duties of a Coordination Unit are:

- to coordinate (a) activities in natural resource conservation and development in the region (between different governmental departments, between the regional administration and governmental departments, between other organisations and initiatives); (b) natural resource development activities by other means (disaster prevention strategy, food and nutrition strategy, information and contacts, especially for international development cooperation agencies);
- to inform concerned actor groups about the natural resource base and its dynamics in Tigray (for example, the major trends in natural resource use and degradation processes), and about institutions and initiatives involved in this field. A Geographical Information System (GIS) database is to be built up for this purpose. It should serve to support political decisions on environmental and development issues, help to set priorities, be used as a tool for planning and implementing natural resource activities, provide an information base that enables interested organs to get the needed data, and be an instrument for building up broad participation and membership in the TREES process;
- to consult with the regional administration, regional MoA and other regional offices, ministries and administrative bodies, and non-governmental organisations and international development cooperation agencies;
- to plan additional environmental and development programme activities, new fund-raising possibilities, and additional measures for further expansion of the TREES process;
- to screen, evaluate, and eventually monitor all interventions in Tigray that have potential impacts on the environment.

3. Institutional set-up of the TREES Coordination Unit

In order to ensure the proper functioning of the above activities, and particularly to guide environmental and development activities in the region, the TREES Coordination Unit should be integrated into the structure of the regional administration and attached to the regional planning office (see organogram in Appendix 2).

The TREES Coordination Unit can only work effectively if the closest relations are established, particularly with the regional MoA, but also with other regional offices, ministries and administrative bodies. Likewise, contacts have to be built up with non-governmental organisations and international development cooperation agencies, and with the farming communities for proper feedback.

4. Prerequisites for establishing the TREES Coordination Unit

In reality, there are heavy financial, human and material constraints as well as a feeling of political insecurity which may all impede initiation of the TREES process. On the other hand, there is a great deal of motivation to overcome these constraints through indigenous efforts.

What are the prerequisites for a TREES Coordination Unit and the priorities for its support?

Staff requirements:

- one or two experts (profile: Tigrayan, university graduate, ecological experience, good communicator and coordinator, to be upgraded with training on the job)
- expertise from outside (external GIS and resource management support, consultation and training in specific subjects)

Material requirements:

- office, office material (typewriters, paper, etc.), vehicle(s), petrol and spare parts
- Geographical Information System (GIS) hardware and software

Financial requirements:

- budgets to cover capital and running costs
- foreign exchange budgets

5. Inputs

Tigray administration:

- staff (experts, administration, secretarial, drivers)
- office space at appropriate location
- support in facilitating activities to build up a network of contacts and information, including priority-setting and a framework to guide development and environmental policies
- interest in integrating the TREES Coordination Unit into the political decision-making process

National Conservation Strategy (NCS) office in Addis Abeba:

- facilitator of the process
- assistance in information coordination
- support with natural resource management expertise

External organisations:

- external manpower support
- foreign exchange support
- organisational support
- material support
- training in specific subjects
- assistance in building up a GIS database (how to get existing data, how to put information together, how to evaluate and assess these)
- monitoring of the process

Appendix 2
April 1992

Major Institutions Involved in Natural Resource Management at the Regional Level in Tigray

1. Regional government departments and other official institutions in Tigray

(a) Ministry of Agriculture (MoA):

- Natural Resources Conservation and Development Department (forestry, soil conservation, land use planning, wildlife)
- Animal and Fisheries Resources Development Department
- Cooperative Promotion
- Rural Infrastructure Development Department
- Agricultural Development Department
- Planning and Programming Department
- Training
- Administration and Finance

(b) Regional office of the Ethiopian Electric, Light and Power Authority (EELPA)

(c) Regional office of the Ministry of Education

(d) Regional office of the National Water Resources Commission

(e) Regional office of the Relief and Rehabilitation Commission (RRC) (recently opened)

(f) Institute of Agricultural Research (will start operations in the near future)

2. Subregional government offices in the Awrajas

- Ministry of Agriculture MoA (different subregional offices)
- Ministry of Education MoE (different offices in the Awrajas)
- EELPA (Ethiopian Electric Light and Power Authority) (in Adigrat and Axum)

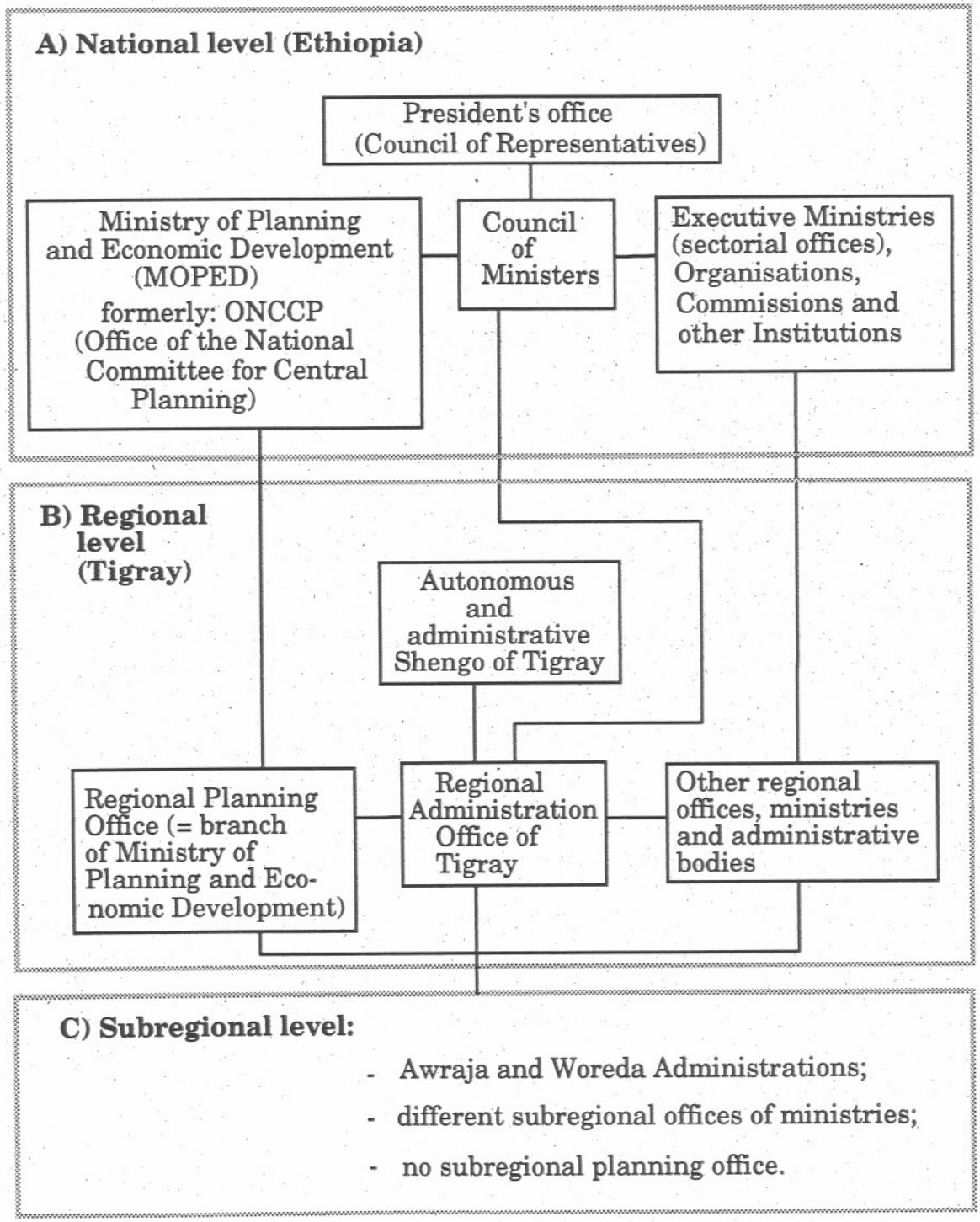
3. International development cooperation agencies and non-governmental organisations in Tigray

Organisation (main activity):

- REST=Relief Society of Tigray (operational in Tigray since 1978; relief society founded by TPLF and international NGOs; mainly relief [food distribution], but also development activities [soil and water conservation]).
- TDA=Tigray Development Association (in operation since 1992; likely to start rural road construction such as an all-season road between Senkata and Haweziu; head office in Addis Abeba)
- UNICEF (rural water supply; head office in Addis Abeba)
- Italian Cooperation (emergency operations, rehabilitation of a clinic and a hospital in Meqhelle (Kwiha) and Adwa Awraja)
- GTZ (likely to start reafforestation)
- ECS=Ethiopian Catholic Secretariat (emergency relief aid, food distribution)
- World Vision (reafforestation; likely to start soil and water conservation in two Weredas in Kilte Awalo Awraja)
- GED=German Emergency Doctors (Axum Hospital)
- Don Bosco (clinic in Adigrat; training centre in construction building, mechanics and electricity in Meqhelle)
- National Red Cross (food distribution and ambulance service)
- MfM=Menschen für Menschen (relief, returnees' assistance)

ORGANOGRAM

Functional structure of the administrative system in Tigray and its relationship to the national administration



Appendix 3
April 1992

Meqhelle Declaration on Environment and Development in Tigray

Aware that no sustainable development can take place without a sound environment, and acting to conform with a process of environmental planning initiated at the national level, the Relief Society of Tigray (REST) and the Tigray Development Association (TDA) invited a select number of scientists, experts, policy makers and field operatives to a symposium on combating environmental degradation in Tigray. One hundred seventy-one people from 11 countries and from 51 local, regional, national and international organisations and offices attended this event held in Meqhelle between 15 and 20 April, 1992, which included a two-day field visit to conservation and degradation areas along the road to Adigrat and Debre Damo.

Impressed by the magnitude of the problems, but also by the dedication of the rural population and the authorities to arresting and reversing environmental deterioration, the participants in the symposium unanimously accepted the following declaration, which is herewith submitted to the attention of the regional administration in Tigray, the Government of Ethiopia, and the international community.

1. *Despite the cessation of the civil war, which caused heavy destruction particularly in Tigray, the region still faces serious threats to the survival of its human and livestock populations due to persistent droughts which greatly affect its agricultural production. Part of the cause of this phenomenon can be found in the environmental degradation in Tigray.*

2. *The present status of the natural resource base was perceived by the participants as characterised by a worsening climatic situation tending towards drier conditions, landscapes devoid of most of their original natural vegetation, a scarcity of wildlife, degraded agricultural soils, especially on slopes but also in sediment accumulations on valley floors, and a greatly reduced availability of water, even drinking water, particularly in the dry season, but also for rainfed agriculture during the rainy seasons. These deteriorating conditions include an erosion of biological diversity and a threat to vital ecological processes. However, despite this negative perception of the natural resource base, the region was not considered to have lost its potential for supporting ecologically sound utilisation, provided that massive efforts are undertaken from within Tigray*

and from outside, and provided that the current participation at all levels can be maintained.

3. *The symposium participants were able to identify some of the root causes of the current problems, which are typical for most parts of Ethiopia, except that persistent civil war in the recent past was concentrated in the northern regions including Tigray. These root causes include:*

   - *the use by the previous systems of government of pillage and carnage to secure maximum centralised authority, which killed all local initiative for development and prevented the sustainable use of natural resources by farming households and communities;*
   - *the engagement of the majority of the population in subsistence agriculture, which prevents them from looking beyond their struggle for survival and reacting to environmental changes;*
   - *the increasing scarcity of land, water, and vegetation resources with the rise in human and livestock densities, and the inability of current agricultural systems to effectively react to changing conditions affecting resources; and*
   - *the generally low level of economic activities and the poor state of present institutions, which lack the capacity for outreach into the farming communities except to extract produce and goods.*

4. *In view of the present situation, particularly when taking into account the current dedication of the people of Tigray at all levels to a collaborative effort to halt degradation and to improve environmental conditions, the following principles for sustainable development are proposed by the participants:*

   - *prepare a multi-level and integrated strategy to deal with and prevent famine in order to maintain the lives, health, and working capacities of the rural population;*
   - *implement an intensive programme of water conservation and development, including on-farm runoff retention, the digging of wells for drinking water, river diversion schemes for supplementary irrigation, the construction of small-scale dams, and the setting up of irrigation schemes;*
   - *implement revegetation activities, especially on slopes, for natural biodiversity regeneration, and plant suitable indigenous and selected exotic tree species to produce fuel and construction wood, to provide soil improvement systems such as windbreaks, to improve soil fertility, and provide water-conserving support systems on cropland and fodder areas, thereby reducing free grazing of livestock in such areas while still utilising their vegetation resources as fodder;*

- *implement soil conservation systems in the form of mechanical and biological measures, particularly on cultivated land which still has a promising production potential, and also on land specifically threatened by erosion, such as areas being destroyed by gullies;*

- *ensure the conservation of biological diversity and indigenous knowledge thereof, and of domesticated plants and animals, by maintaining all existing agricultural systems in selected areas and compensating the farmers in those areas for gains foregone; ensure conservation of wild plants and animals by revegetating all agriculturally unsuitable areas with native species and setting aside selected representative agriculturally suitable areas for revegetation with native species and reintroduction of animals that are no longer found in the area;*

- *enhance agricultural production on ecologically suitable land in order to attain food self-sufficiency for the growing population of Tigray;*

- *favour economic development in the production sector, particularly in support of agricultural production and the processing of agricultural products as a first priority, thereby offering employment outside the agricultural sector;*

- *introduce family planning activities, especially until rates of population growth are lower than rates of economic growth;*

- *develop the necessary infrastructures for education, information and communication, transport, research activities oriented toward environment and development, and formation and consolidation of the necessary institutions.*

5. *In view of the enormous tasks ahead for the population of Tigray, the participants herewith pledge to commit themselves to the ends proposed above, and to make available their respective capacities and networks for this and other similar regional efforts in Ethiopia. Furthermore, national governments as well as international and non-governmental organisations are invited to do their best to support the programmes indicated above. The process being initiated, however, is not unique to Tigray, although it is the first of its kind in Ethiopia. The participants would greatly appreciate similar approaches in other regions of Ethiopia and in other degraded areas of the world.*

Endorsed by the plenary meeting of the symposium in Meqhelle, Tigray on this the 20th of April 1992.